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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/030,656	01/11/2002	Masaaki Hagihara	07553.0029	4656

7590

08/26/2003

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EXAMINER

OLSEN, ALLAN W

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 08/26/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/030,656

Applicant(s)

HAGIHARA ET AL.

Examiner

Allan W. Olsen

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 June 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 4 and 6-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 4 and 6-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 11 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 11 recites the limitation "said ashing step and said H2 etching step". There is insufficient antecedent basis for both the ashing step and the H2 etching step.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim 4 is rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,093,632 issued to Lin.

Lin teaches a method of etching silicon nitride. Lin teaches using a plasma comprising CH₃F to etch a layer of silicon nitride and thereby exposing an underlying copper layer. See column 3, line 55; column 4, lines, 48-54; column 5, line 66- column 6, line 3.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6-10 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin as applied to claim 4 above and further in view of U.S. Patent 6,204,192 issued to Zhao et al. (hereinafter, Zhao).

The above noted teachings of Lin are herein relied upon. Furthermore, it is noted that Lin teaches the use of CH₂F₂ and CH₃F as nitride etchants.

Lin does not teach the inclusion of oxygen in the nitride etching gas. Lin does not teach a hydrogen plasma treatment of the exposed copper layer. Lin does not teach the inclusion of an inert gas in the nitride etchant.

Zhao teaches etching a nitride layer with a mixture of a fluoromethane and oxygen. Following the removal of the photoresist by ashing, Zhao teaches treating the exposed copper layer with a hydrogen plasma.

It would have been obvious to one skilled in the art to add the oxygen of Zhao's nitride etch into Lin's fluoromethane based etch the nitride layer because Zhao teaches that it is conventional to include oxygen (column 4, lines 32-34). It would have been obvious to one skilled in the art to treat the exposed copper layer to a hydrogen plasma because Zhao teaches that the copper oxides that are formed during the photoresist ashing step are removed by the hydrogen plasma treatment. The examiner takes Official Notice that is well known that using an inert gas as a diluent provides many advantages, such as, improving the anisotropy and increasing the safety of plasma process as well as enhancing the ability of an operator to control process parameters such as the flow ratio of reactive components in the etchant gas mixture.

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Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin and Zhao as applied to claim 6 above, and further in view of Hung.

The Lin/Zhao combination does not teach conducting the various etching processes within a single etching chamber.

Hung teaches that multiple steps may be carried out within the same plasma chamber. See: column 6, lines 46-53; column 7, lines 35-58; column 10, lines 68-63

It would have been obvious to one skilled in the art to conduct the process within a single chamber because Hung teaches that the practice of carrying out a multistep process within a single chamber significantly increases the efficiency of the overall process.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 703-306-9075. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Greg Mills, can be reached on 703-308-1633.

The general fax numbers for TC1700 are 703-872-9310 (non-after finals) and 703-872-9311(after-final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.
August 18, 2003

A handwritten signature in black ink, appearing to read "Allan Olsen", with a long horizontal flourish extending to the right.